

WE CLAIM:

1. A method of reducing a microbial population on carcass, meat, or meat product during processing comprising:

5 applying to the carcass, meat, or meat product during processing a medium chain peroxycarboxylic acid antimicrobial composition in an amount and time sufficient to reduce the microbial population;

the medium chain peroxycarboxylic acid antimicrobial composition comprising:

about 2 to about 500 ppm peroxyoctanoic acid;

10 about 5 to about 2000 ppm octanoic acid;

about 95 to about 99.99 wt-% water; and

about 2 to about 23,000 ppm polyalkylene oxide, monoalkyl ether of polyalkylene oxide, dialkyl ether of polyalkylene oxide, nonionic surfactant, anionic surfactant, or mixture thereof;

15 the composition comprising at least about 2 parts by weight of peroxyoctanoic acid for each 7 parts by weight of octanoic acid.

2. A method of recycling water previously applied to carcass, meat, or meat product, the method comprising:

20 recovering a medium chain peroxycarboxylic acid antimicrobial composition previously applied to carcass, meat, or meat product; and

adding to the recovered composition a sufficient amount of a medium chain peroxycarboxylic acid composition to yield a recycled medium chain peroxycarboxylic acid antimicrobial composition;

25 the added medium chain peroxycarboxylic acid composition comprising:

about 0.0005 to about 5 wt-% peroxyoctanoic acid;

about 0.001 to about 10 wt-% octanoic acid;

about 5 to about 99.99 wt-% water;

30 about 0.001 to about 60 wt-% polyalkylene oxide, monoalkyl ether of polyalkylene oxide, dialkyl ether of polyalkylene oxide, nonionic surfactant, anionic surfactant, or mixture thereof;

about 0.002 to about 10 wt-% oxidizing agent;
about 0.001 to about 30 wt-% inorganic acid; and
about 0.001 to about 5 wt-% sequestrant;
the composition comprising at least about 2 parts by weight of peroxyoctanoic
5 acid for each 7 parts by weight of octanoic acid.

3. A method of recycling water previously applied to carcass, meat, or meat
product, the method comprising:
recovering a medium chain peroxycarboxylic acid antimicrobial composition
10 previously applied to carcass, meat, or meat product; and
adding to the recovered composition a sufficient amount of a medium chain
peroxycarboxylic acid composition to yield a recycled medium chain peroxycarboxylic acid
antimicrobial composition;
the added medium chain peroxycarboxylic acid composition comprising:
15 about 0.5 to about 5 wt-% peroxyoctanoic acid;
about 1 to about 10 wt-% octanoic acid;
about 5 to about 97 wt-% water;
about 1 to about 20 wt-% anionic surfactant;
about 5 to about 10 wt-% oxidizing agent;
20 about 15 to about 35 wt-% inorganic acid; and
about 1 to about 5 wt-% sequestrant;
the composition comprising a microemulsion.

4. A method of recycling water previously applied to carcass, meat, or meat
25 product, the method comprising:
recovering a medium chain peroxycarboxylic acid antimicrobial composition
previously applied to carcass, meat, or meat product; and
adding to the recovered composition a sufficient amount of a medium chain
peroxycarboxylic acid composition to yield a recycled medium chain peroxycarboxylic acid
30 antimicrobial composition;
the added medium chain peroxycarboxylic acid composition comprising:

about 0.0005 to about 5 wt-% peroxyoctanoic acid;
about 0.001 to about 10 wt-% octanoic acid;
about 40 to about 99.99 wt-% water;
about 0.001 to about 60 wt-% polyalkylene oxide, monoalkyl ether of
5 polyalkylene oxide, dialkyl ether of polyalkylene oxide, anionic surfactant, nonionic
surfactant, or mixture thereof, or mixture thereof;
about 0.002 to about 10 wt-% oxidizing agent;
about 0.001 to about 30 wt-% inorganic acid; and
about 0.001 to about 5 wt-% sequestrant.

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5. An antimicrobial concentrate composition comprising:
a medium chain peroxycarboxylic acid composition effective for reducing the
microbial burden on a surface of carcass, meat, or meat product;
the composition comprising:

15 about 0.0005 to about 5 wt-% peroxyoctanoic acid;
about 0.001 to about 10 wt-% octanoic acid;
about 5 to about 99.99 wt-% water;
about 0.001 to about 60 wt-% polyalkylene oxide, monoalkyl ether of
polyalkylene oxide, dialkyl ether of polyalkylene oxide, nonionic surfactant, anionic
20 surfactant, or mixture thereof;
about 0.002 to about 10 wt-% oxidizing agent;
about 0.001 to about 30 wt-% inorganic acid; and
about 0.001 to about 5 wt-% sequestrant;
the composition comprising at least about 2 parts by weight of peroxyoctanoic
25 acid for each 7 parts by weight of octanoic acid.

6. An antimicrobial concentrate composition comprising:
a medium chain peroxycarboxylic acid composition effective for reducing the microbial
burden on a surface of carcass, meat, or meat product;
30 the composition comprising:
about 0.5 to about 5 wt-% peroxyoctanoic acid;

about 1 to about 10 wt-% octanoic acid;
about 5 to about 97 wt-% water;
about 1 to about 20 wt-% anionic surfactant;
about 5 to about 10 wt-% oxidizing agent;
5 about 15 to about 35 wt-% inorganic acid; and
about 1 to about 5 wt-% sequestrant;
the composition comprising a microemulsion.

7. An antimicrobial concentrate composition comprising:
10 a medium chain peroxycarboxylic acid composition effective for reducing the microbial
burden on a surface of carcass, meat, or meat product;
the composition comprising:
about 0.0005 to about 5 wt-% peroxyoctanoic acid;
about 0.001 to about 10 wt-% octanoic acid;
15 about 40 to about 99.99 wt-% water;
about 0.001 to about 60 wt-% polyalkylene oxide, monoalkyl ether of
polyalkylene oxide, dialkyl ether of polyalkylene oxide, anionic surfactant, nonionic
surfactant, or mixture thereof, or mixture thereof;
about 0.002 to about 10 wt-% oxidizing agent;
20 about 0.001 to about 30 wt-% inorganic acid; and
about 0.001 to about 5 wt-% sequestrant.

8. A method of reducing a microbial population on carcass, meat, or meat
product during processing comprising:
25 applying to the carcass, meat, or meat product during processing a medium chain
peroxycarboxylic acid antimicrobial composition in an amount and time sufficient to reduce
the microbial population.

9. The method of claim 8, wherein the carcass, meat, or meat being processed
30 comprises beef, pork, sheep, goat, buffalo, scallops, shrimp, crab, octopus, mussels, squid,
lobster, chicken, turkey, ostrich, game hen, squab, pheasant, or mixture thereof.

10. The method of claim 9, wherein the carcass, meat, or meat being processed comprises a muscle meat comprising beef, pork, veal, buffalo or lamb.

5 11. The method of claim 8, wherein the carcass, meat, or meat being processed comprises sea food comprising scallops, shrimp, crab, octopus, mussels, squid or lobster.

12. The method of claim 8, wherein the carcass, meat, or meat product comprises organ, bone, whole carcass, whole carcass, or mixture thereof.

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13. The method of claim 8, wherein the meat product comprises hot dogs, cold cuts, sausage, meat cuts, hamburger, sushi, or mixture thereof.

14. The method of claim 8, comprising applying the medium chain
15 peroxycarboxylic acid composition by submersing the carcass, meat, or meat product.

15. The method of claim 8, comprising applying the medium chain peroxycarboxylic acid composition by rinsing or spraying the carcass, meat, or meat product.

20 16. The method of claim 8, comprising applying the medium chain peroxycarboxylic acid composition to a whole carcass.

17. The method of claim 16, comprising applying the medium chain peroxycarboxylic acid composition to a carcass that has been subjected to stunning, bleeding,
25 scalding, dehairing, skinning, or a combination thereof.

18. The method of claim 8, comprising applying the medium chain peroxycarboxylic acid composition to one or more dismembered parts of a carcass.

19. The method of claim 18, comprising applying the medium chain peroxydicarboxylic acid composition to a carcass that has been subjected to beheading, halving, quartering, or a combination thereof.

5 20. The method of claim 8, comprising applying the medium chain peroxydicarboxylic acid composition by air chilling.

21. The method of claim 20, wherein the medium chain peroxydicarboxylic acid composition comprises peroxyoctanoic acid.

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22. The method of claim 20, wherein air chilling comprises applying a gaseous or densified fluid antimicrobial composition.

15 23 The method of claim 8, further comprising exposing the carcass, meat, or meat product to activated light.

24. The method of claim 23, wherein the activated light comprises ultraviolet light, infrared light, visible light, or a combination thereof.

20 25. The method of claim 8, wherein the medium chain peroxydicarboxylic acid antimicrobial composition comprises:

about 2 to about 500 ppm medium chain peroxydicarboxylic acid;

about 5 to about 2000 ppm medium chain dicarboxylic acid;

about 95 to about 99.99 wt-% water; and

25 about 2 to about 23,000 ppm solubilizer.

26. The method of claim 25, wherein the medium chain peroxydicarboxylic acid antimicrobial composition further comprises stabilizing agent, wetting agent, thickener, foaming agent, acidulant, pigment, dye, or a combination thereof.

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27. The method of claim 8, wherein the microbial population is the result of contamination by fecal matter or digestive tract content.

28. The method of claim 8, further comprising immersing implement employed in processing the carcass, meat, or meat product in implement cleaner containing medium chain peroxycarboxylic acid composition in an amount and for time sufficient to reduce the microbial population.

29. The method of claim 8, further comprising, after applying:
recovering the applied medium chain peroxycarboxylic acid antimicrobial composition; and
adding to the recovered composition a sufficient amount of a medium chain peroxycarboxylic acid to yield a recycled medium chain peroxycarboxylic acid antimicrobial composition.

30. The method of claim 29, further comprising applying the recycled composition to carcass, meat, or meat product during processing.

31. The method of claim 29, wherein the medium chain peroxycarboxylic acid comprises:
about 0.5 to about 5 wt-% medium chain peroxycarboxylic acid;
about 1 to about 10 wt-% medium chain carboxylic acid;
about 5 to about 97 wt-% water; and
about 1 to about 20 wt-% microemulsion former;
the composition comprising a microemulsion.

32. The method of claim 29, wherein the medium chain peroxycarboxylic acid comprises:
about 0.0005 to about 5 wt-% medium chain peroxycarboxylic acid;
about 0.001 to about 10 wt-% medium chain carboxylic acid;
about 0.001 to about 99.99 wt-% water; and

about 0.001 to about 80 wt-% solubilizer effective for solubilizing the medium chain peroxydicarboxylic acid and the medium chain dicarboxylic acid;

the composition comprising about 2 or more parts by weight of medium chain peroxydicarboxylic acid for each 7 parts by weight of medium chain dicarboxylic acid.

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33. The method of claim 29, wherein the medium chain peroxydicarboxylic acid comprises:

about 0.0005 to about 5 wt-% medium chain peroxydicarboxylic acid;

about 0.001 to about 10 wt-% medium chain dicarboxylic acid;

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about 40 to about 99.99 wt-% water; and

about 0.001 to about 80 wt-% solubilizer effective for solubilizing the medium chain peroxydicarboxylic acid and the medium chain dicarboxylic acid.

34. The method of claim 29, wherein the recycled medium chain peroxydicarboxylic acid antimicrobial composition comprises:

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about 2 to about 500 ppm medium chain peroxydicarboxylic acid;

about 5 to about 2000 ppm medium chain dicarboxylic acid;

about 95 to about 99.99 wt-% water; and

about 2 to about 23,000 ppm solubilizer.

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35. The method of claim 8, applying comprising fogging the carcass, meat, or meat product.

36. The method of claim 8, applying comprising foaming the carcass, meat, or meat product.

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37. The method of claim 8, applying comprising applying a thickened or gelled composition to the carcass, meat, or meat product.

38. The method of claim 8, further comprising vacuum treating the carcass, meat, or meat product.

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39. A method of recycling water previously applied to carcass, meat, or meat product, the method comprising:

recovering a medium chain peroxycarboxylic acid antimicrobial composition
5 previously applied to carcass, meat, or meat product; and
adding to the recovered composition a sufficient amount of a medium chain peroxycarboxylic acid to yield a recycled medium chain peroxycarboxylic acid antimicrobial composition.

10 40. The method of claim 39, further comprising applying the recycled composition to carcass, meat, or meat product during processing.

41. The method of claim 39, wherein the medium chain peroxycarboxylic acid composition comprises:

15 about 0.0005 to about 5 wt-% medium chain peroxycarboxylic acid;
about 0.001 to about 10 wt-% medium chain carboxylic acid;
about 0.001 to about 99.99 wt-% water; and
about 0.001 to about 80 wt-% solubilizer effective for solubilizing the medium chain peroxycarboxylic acid and the medium chain carboxylic acid;
20 the composition comprising about 2 or more parts by weight of medium chain peroxycarboxylic acid for each 7 parts by weight of medium chain carboxylic acid.

42. The method of claim 39, wherein the medium chain peroxycarboxylic acid composition comprises:

25 about 0.5 to about 5 wt-% medium chain peroxycarboxylic acid;
about 1 to about 10 wt-% medium chain carboxylic acid;
about 5 to about 97 wt-% water; and
about 1 to about 20 wt-% microemulsion former;
the composition comprising a microemulsion.

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43. The method of claim 39, wherein the medium chain peroxydicarboxylic acid composition comprises:

about 0.0005 to about 5 wt-% medium chain peroxydicarboxylic acid;

about 0.001 to about 10 wt-% medium chain dicarboxylic acid;

5 about 40 to about 99.99 wt-% water; and

about 0.001 to about 80 wt-% solubilizer effective for solubilizing the medium chain peroxydicarboxylic acid and the medium chain dicarboxylic acid.

44. The method of claim 39, wherein the composition was previously applied by a
10 carcass wash or rinse.

45. An antimicrobial concentrate composition comprising:

a medium chain peroxydicarboxylic acid composition effective for reducing the microbial burden on a surface of carcass, meat, or meat product;

15 the composition comprising:

about 0.5 to about 5 wt-% medium chain peroxydicarboxylic acid;

about 1 to about 10 wt-% medium chain dicarboxylic acid;

about 5 to about 97 wt-% water; and

about 1 to about 20 wt-% microemulsion former;

20 the composition comprising a microemulsion.

46. An antimicrobial concentrate composition comprising:

a medium chain peroxydicarboxylic acid composition effective for reducing the microbial burden on a surface of carcass, meat, or meat product;

25 the composition comprising:

about 0.0005 to about 5 wt-% medium chain peroxydicarboxylic acid;

about 0.001 to about 10 wt-% medium chain dicarboxylic acid;

about 0.001 to about 99.99 wt-% water; and

30 about 0.001 to about 80 wt-% solubilizer effective for solubilizing the medium chain peroxydicarboxylic acid and the medium chain dicarboxylic acid;

the composition comprising about 2 or more parts by weight of medium chain peroxydicarboxylic acid for each 7 parts by weight of medium chain dicarboxylic acid.

47. An antimicrobial concentrate composition comprising:

5 a medium chain peroxydicarboxylic acid composition effective for reducing the microbial burden on a surface of carcass, meat, or meat product;

the composition comprising:

about 0.0005 to about 5 wt-% medium chain peroxydicarboxylic acid;

about 0.001 to about 10 wt-% medium chain dicarboxylic acid;

10 about 40 to about 99.99 wt-% water; and

about 0.001 to about 80 wt-% solubilizer effective for solubilizing the medium chain peroxydicarboxylic acid and the medium chain dicarboxylic acid.

48. An antimicrobial use composition comprising:

15 a medium chain peroxydicarboxylic acid composition effective for reducing the microbial burden on a surface of carcass, meat, or meat product;

the composition comprising:

about 2 to about 500 ppm medium chain peroxydicarboxylic acid;

about 5 to about 2000 ppm medium chain dicarboxylic acid;

20 about 95 to about 99.99 wt-% water; and

about 2 to about 23,000 ppm solubilizer.

49. A method of treating a carcass, meat, or meat product to reduce a microbial population in the carcass, meat, or meat product, the method comprising:

25 spraying a medium chain peroxydicarboxylic acid composition onto the carcass, meat, or meat product at a pressure of at least 50 psi at a temperature of up to about 60°C resulting in a contact time of at least 30 seconds; and

achieving at least a one log₁₀ reduction in the microbial population.

30 50. The method of claim 49, wherein the antimicrobial composition comprises about 2 to about 500 ppm medium chain peroxydicarboxylic acid;

about 5 to about 2000 ppm medium chain carboxylic acid;
about 95 to about 99.99 wt-% water; and
about 2 to about 23,000 ppm solubilizer.

5 51. The method of claim 49, comprising applying the antimicrobial composition with electrostatically accelerated spray.

 52. A method of treating a meat product to reduce a microbial population in the carcass, meat, or meat product, the method comprising:
10 placing the carcass, meat, or meat product in a chamber at atmospheric pressure;
 filling the chamber with condensing steam comprising a medium chain peroxycarboxylic acid composition for a short duration; and
 quickly venting and cooling the chamber to prevent browning of the carcass, meat, or meat product; wherein the duration of the steam thermal process may be from about 5
15 seconds to about 30 seconds and the chamber temperature may reach from about 50 °C to about 93°C.

 53. The method of claim 52, wherein the antimicrobial composition comprises:
 about 2 to about 500 ppm medium chain peroxycarboxylic acid;
20 about 5 to about 2000 ppm medium chain carboxylic acid;
 about 95 to about 99.99 wt-% water; and
 about 2 to about 23,000 ppm solubilizer.

 54. The method of claim 53, comprising applying the antimicrobial composition
25 with electrostatically accelerated spray.

 55. A method of reducing a microbial population on meat processing surface, the method comprising:
 applying to the meat processing surface medium chain peroxycarboxylic acid
30 antimicrobial composition in amount and for time sufficient to reduce the microbial population.